

# Studies on the Green Alga, *Udotea indica* A. & E. S. Gepp, 1911

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**ABSTRACT:** In *Udotea indica* reproductive organs are terminal and club-shaped. Numerous biflagellate zooids are produced in the reproductive organs. *Udotea* is named as the type of a new family, Udoteaceae.

*Udotea indica* A. & E. S. Gepp (1911) was first collected by J. A. Murray (in 1880–83) from Karachi near the mouth of the Indus River. The type specimen is in the British Museum and the type locality is Karachi. Previous taxonomic studies have been made, notably by Boergesen (1930, 1934) and Taylor (1950). This species has also been reported from Bikini and other areas in the Marshall Islands by Taylor (1950). It grows in association with *Chaetomorpha* sp. on silt-covered rocks along the edges of littoral rocky pools, where it generally occurs in patches, but elsewhere it may be found scattered on rocky platforms.

The genus has been included in the family Codiaceae by previous authors. The present study excludes *Udotea* from the Codiaceae and places it in a family of its own. The basis for this conclusion is that in *Udotea indica* the terminal portions of the filaments are transformed into reproductive organs, in contrast to the lateral position of the reproductive organs in the genera of the family Codiaceae.

The discovery, made while examining living material, that the reproductive bodies are motile made a thorough investigation of this *Udotea* necessary. The present account gives the preliminary results of this study and, while not completely clarifying many features, shows that *U. indica* is not a member of the Codiaceae. The structure and reproduction of this species are discussed below.

The thalli are up to 4 cm long, as much broad, and are slightly calcified. The root-mass forms a small tuft. The terete stipe is up to 1.2 cm

long and 1 mm thick. The fronds are green, somewhat rounded, flabellate, orbicular, and sometimes broadly proliferated above; the base is cuneate, distinctly zonate. The blade margins are entire, lobed, or lacerated.

Filaments 31–48  $\mu$  in diameter, radiating from the stipe to the margin, slightly parallel or interdigitated, pluriseriate to triseriate, dichotomously branched, supra-dichotomal constriction uneven. The filaments possess numerous unilateral or bilateral, short or pedicellate or truncate appendages that are simple or lobed. The appendages are so fitted together as to form a primitive cortex. The filaments of stipes are irregularly dichotomously branched, having lateral appendages (Fig. 1a-e). Reproductive organs formed terminally on the filament (Fig. 1d, e), each with a thick constriction in the middle, up to 16.2 mm long and 2.4 mm broad.

The present effort is the first study made of reproduction in *Udotea*. The previous report on the presence of reproductive organs was considered erroneous by Ernst (1904) and Fritsch (1956), who supposed the structures reported as reproductive to be epiphytes.

The filaments are compact and interdigitated; but when fruiting occurs the terminal parts swell and separate, and cytoplasm passes into the swollen parts, forming reproductive organs. The lower part of each serves as a stalk of the reproductive organ (Fig. 1e). The terminal portion of the fertile frond becomes loose, and as the filaments separate the reproductive organs show (Fig. 2); but in vegetative fronds the terminal edge of a blade is compact.

Numerous zooids are produced and they are liberated successively through an apical pore. On liberation of the zooids the middle constrict-

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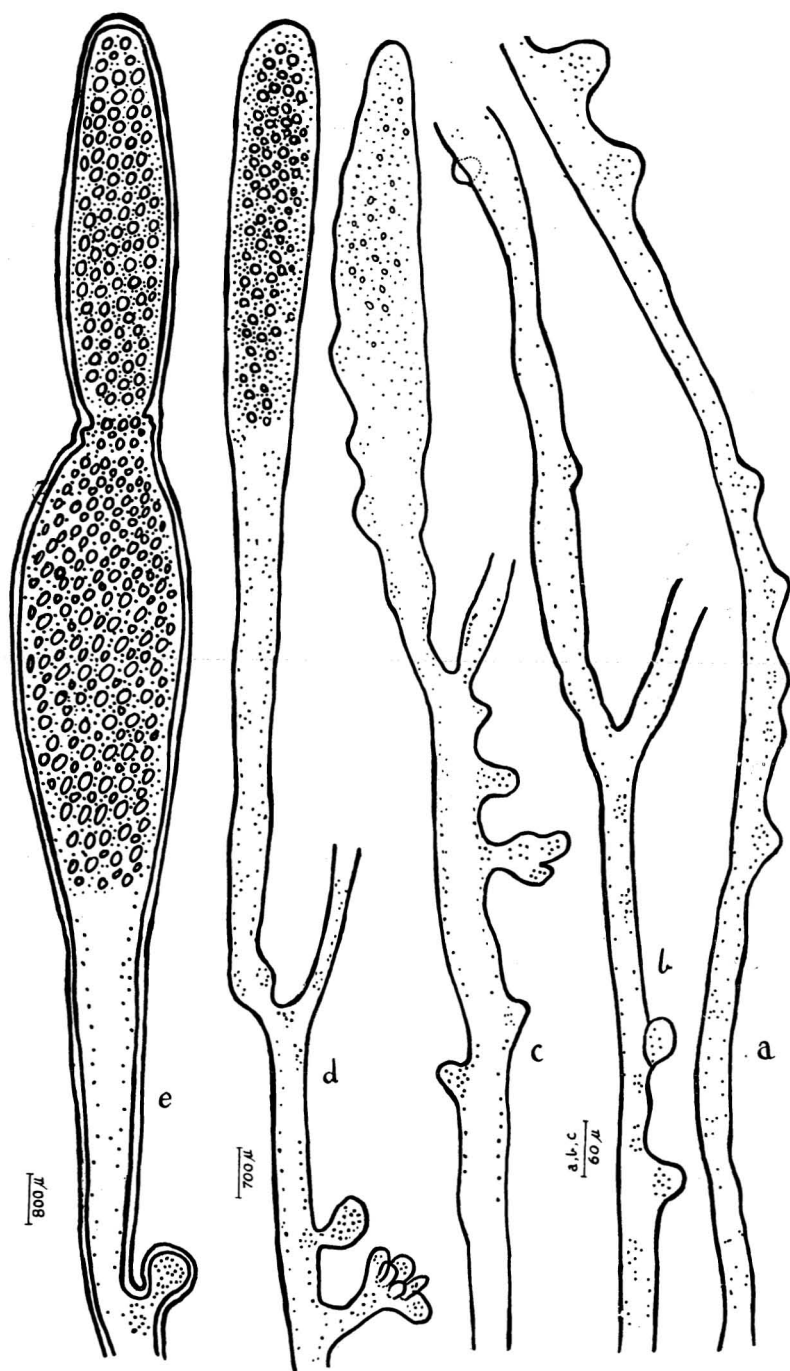


FIG. 1. *Udotea indica*. *a*, Lower part of a filament; *b*, middle part of a filament; *c*, upper part of a filament; *d*, upper part of a filament, showing reproductive organ; *e*, upper part of a filament, showing mature reproductive organ.

tion relaxes, increasing in diameter, and thus making way for the contents from the basal part to stream into the terminal part of the reproductive organ. This process is continued until all the zooids are extruded. These zooids seem to be morphologically similar. Fusion between them has not been observed. Their study is still in progress.

In *Codium* and *Halimeda* special lateral gametangia are formed, whereas in *Udotea indica* terminal reproductive organs are formed. Such terminal club-shaped sporangium formation has been observed (Howe, 1907) on blades of *Avrainvillea*. This transformation of the terminal parts of the filaments into reproductive organs clearly distinguishes these genera from other members of the family Codiaceae.

The filaments of *Udotea indica* resemble those of *Codium* and *Halimeda* in their siphonaceous and dichotomous character, but differ in possessing uni- or bi-lateral appendages. The filaments in *Avrainvillea* are moniliform in appearance, due to the numerous constrictions, but whereas

appendages are found in *Udotea* there are none in *Avrainvillea*.

*Udotea* certainly represents a distinctive family, which I here name the Udoteaceae, but the systematic position of this family must await more complete knowledge of its members' life histories.

*Udoteaceae* fam. nov.

Frond flabellate, orbicular, broadly proliferated above. The base cuneate, distinctly zonate, margin entire, lobed, or lacerated. Filaments radiating from stipe to the margin, slightly parallel or interdigitated, pluriseriate to triseriate, dichotomously branched, supra-dichotomal constriction uneven, uni- or bi-lateral short pedicellate or truncate appendages simple or lobed. Appendages so fitted together as to form a primitive cortex. Terminally formed reproductive organ with a thick constriction.

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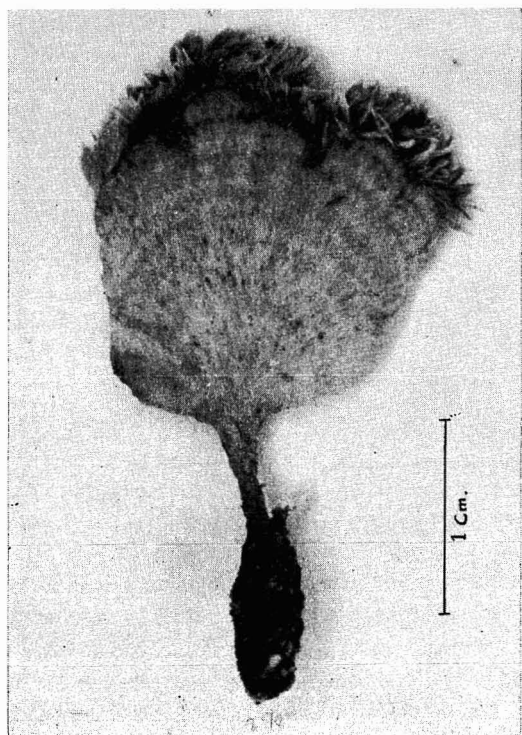


FIG. 2. Fertile plant.